WORKING DRAFT

Whitefish Urban Corridor Study of US Highway 93
Technical Memorandum – Task 19

Analysis of Future Traffic Conditions on US 93 through Whitefish

Prepared For:

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TECHNICAL MEMORANDUM – TASK 19
Analysis of Future Conditions

This technical memorandum looks at the future traffic conditions and operations of the US 93 corridor in Whitefish expected to occur in the year 2030. This analysis establishes a "baseline" of future conditions which can then be used to help evaluate potential design and improvement options in the US 93 corridor. The future conditions are based on travel demand modeling and simulation practices described in this memorandum. The information used for the modeling and simulation comes from future forecasting methods contained in the Whitefish Transportation Plan and other information described in the corridor study.

WHITEFISH PLANNING AREA FUTURE TRAVEL DEMAND FORECASTING

The method and process developed to predict growth in the Whitefish area up to the year 2030 is described in detail in Chapter 3 of the Whitefish Transportation Plan and briefly summarized below. Through the use of population, employment and other socio-economic projections, the needs for the future transportation system along the US 93 corridor were defined. A model of the future (2030) network in the Whitefish area was created using the projected traffic demand determined from analysis of the socio-economic information, as well as changes to the transportation system that are expected to occur before the year 2030. The following section provides detailed information about how the future year traffic model was created.

Future Street Network

For the purposes of the corridor study, the future street network in the Whitefish area was assumed to consist of the existing system plus committed projects expected to be in place by the year 2030. The Whitefish Transportation Plan refers to this future street network as the "E+C Network." MDT's Whitefish-West project is the only "committed" transportation improvement included on the E+C Network. The Whitefish-West project extends from Reference Post (RP) 127.8 (located on 2nd Street between Baker and Lupfer Avenues) to RP 133.0 west of Whitefish and is currently in the design phase. No local improvements to the transportation network were assumed to be in place by the year 2030.

The Whitefish Transportation Plan recommends numerous and extensive improvements to the local street network including new bridges and road connections in order to help meet the anticipated traffic demands for the year 2030. Some of these recommended projects are located on routes that fall under the MDT's jurisdiction; however, most of the recommendations affect streets and roads that fall under the responsibility of either the City of Whitefish or Flathead County. There is no certainty that MDT or these local governments can or will implement all of these projects over the planning horizon. For this reason, the E+C Network presents a very "conservative" representation of the future street system in Whitefish. Modeling the E+C Network provides analysts with an indication of what future operating conditions on the local road and street network may be like without expanding the capacity on US 93 or major system improvements.

Traffic Model Development

The year 2030 was selected as the planning horizon for the future year traffic model. The model takes into account socio-economic and growth projections for the community through the allocation of new housing units and employment through the year 2030 for the Whitefish area. These allocations were consistent with the assumptions about future growth and development included in the Whitefish City-County Growth Policy.

All of the characteristics of the greater Whitefish area influence the traffic patterns present in the community today. To build a model to represent this condition, the housing information was collected from the 2000 census and then updated to include housing from to the year 2003, utilizing Department of Revenue data. The employment information was gathered from the Montana Department of Labor and Industry, second quarter of 2003 and was carefully scrutinized by local agency planners and MDT staff.

The roadway network/centerline information was provided by the Flathead County GIS office. This information was supplemented by input from staff from the City of Whitefish, Flathead County, and MDT. With this substantial local knowledge, the accuracy of the base model was increased.

The GIS files, population census information, and employment information are readily available and summaries of the housing and employment forecasts are presented in the Whitefish Transportation Plan. The *TransCAD* software is designed to use this information as input data and was used as the transportation modeling software for this project. *TransCAD* performs a normal modeling process of generating, distributing and assigning traffic in order to generate traffic volumes. These traffic volumes are then compared to actual ground counts and adjustments are made to "calibrate", or ensure the accuracy of, the model.

It should be noted that since these models are based on forecasted land uses and existing travel patterns, the resulting traffic volumes are not expected to be completely accurate but only to assist in the evaluation of projected future conditions.

To develop a transportation model, the modeling area must be established. The modeling area is, by necessity, much larger than the Study Area. The Study area for the Whitefish Transportation Plan is the same as the Whitefish Planning Jurisdiction Area considered in the City-County Growth Policy. Traffic generated from outlying communities or areas contributes to the traffic load within the Whitefish Study Area, and is therefore important to accuracy of the model. Additionally, it is desirable to have a large model area for use in future projects.

The modeling area was subdivided by using census tracts and census blocks, as previously described in this memorandum. Census blocks are typically small in the downtown and existing neighborhood areas, and grow geographically larger in the less densely developed areas. The census blocks and census tracts were used to allocate the population and employment growth anticipated to occur between now and 2030.

Traffic Simulation and Analysis

Traffic simulation software is used to determine how a roadway, intersection, or network performs under designated conditions. *Synchro* plus *SimTraffic 6,* designed by Trafficware Ltd., was used to simulate traffic behavior, optimize signal timings, and perform analysis throughout the specified network. For the purposes of the corridor study, the network consists of every intersection along Spokane Avenue between 13th Street and 2nd Street, every intersection along Baker Avenue between 13th[h] Street and 2nd Street, and the intersection of Central Avenue and 2nd Street.

Synchro requires peak-hour turning movement volumes to be input at each intersection in the network. These turning movement volumes came from taking twelve percent (12%) of the modeled traffic volumes output by the *TransCAD* traffic model described earlier. The geometry of the future network and of each intersection was based on the geometry in place today.

The signal timing for future conditions was determined by using the "optimize" function in *Synchro*. This feature allows *Synchro* to optimize cycle lengths, splits and offsets to determine the situation that performs at the best level for the entire network. Signal timing for existing conditions was based on current signal timing values obtained from MDT. Once the network is set up with the appropriate geometry, traffic volumes and signal timings, an analysis of the network and of each individual intersection can be done. The analysis process was also done via *Synchro*, which is capable of producing detailed reports for "Intersection Capacity Analysis" and "Measures of Effectiveness".

Information about vehicle delays and the projected future Level of Service (LOS) for each intersection, as determined through the "Intersection Capacity Analysis", is presented later in this memorandum.

PROJECTED TRAFFIC CONDITIONS (2030)

This section examines projected traffic conditions in the year 2030 on the E+C Network. The future traffic conditions for the Whitefish area were predicted through the use of the traffic model and analysis methods discussed earlier. These tools are helpful to identify future problems on the road and street network and determine possible solutions to help the network perform at a higher level.

Future Traffic Volumes and Capacity Considerations

Using the traffic model, it was possible to project traffic volumes on all major roads within the Whitefish study area. These roads were analyzed for the base year 2003 and for the future year 2030 to determine where congestion is likely and volume changes expected to occur on the network by the year 2030. The volumes generated by the model are a reflection of the future year housing and employment projections.

The modeled traffic volumes on the US 93 corridor, Baker Avenue, and adjoining streets for the years 2003 and 2030 as determined through the traffic model can be found in **Figure 1**. Changes in modeled traffic volumes at selected locations for the years 2003 and 2030 are highlighted in **Table 1**.

The travel demand model projects substantial increases in traffic volumes throughout the Whitefish Study Area by the year 2030. Model results show future traffic volumes at locations along Spokane Avenue ranging from 1.2 to 2.0 times higher than modeled volumes for 2003. Traffic volume increases along 2nd Street show future volumes that are 1.5 times higher than those for 2003. Likewise, modeling shows future traffic volumes along Baker Avenue could be about 1.3 to 1.5 times above modeled volumes for 2003. Consistent with the range of projected volume increases on Spokane Avenue in the vicinity of 13th Street, the model predicts significant increases in traffic volumes on 13th Street both east and west of Spokane by the year 2030.


RAILWAY ST
1ST ST
2ND ST
E 2ND ST
3RD ST
4TH ST
5TH ST
6TH ST
W 7TH ST
7TH ST
8TH ST
9TH ST
10TH ST
13TH STREET
W 15TH ST
VOERMAN RD
7th Street Bridge
13th Street Extension
13th Street Bridge
BAKER AVE
CENTRAL AVE
SPOKANE AVE
KALISPELL AVE
COLUMBIA AVE
SOMERS AVE
PARK AVE
PINE AVE
ASHAR AVE
CREEKWOOD DR
MILES AVE
O'BRIEN AVE
LUPFER AVE
SCOTT AVE
JENNINGS AVE
GOOD AVE
GEDDES AVE
93
WHITEFISH
URBAN CORRIDOR STUDY OF U.S. 93
*Note: The traffic volumes depicted in this graphic represent the results of a modeling exercise and may not accurately represent actual values.
ROBERT PECCIA & ASSOCIATES
Legend
Projected 2003 Traffic Volume
Projected 2030 Traffic Volume
Recommended Project
City Boundary
Urban Boundary
Corridor Studied
Traffic Volumes for Existing and Projected (2030) Conditions*
Figure 1
N
0 0.05 0.1 0.15 0.2 0.25 Miles

Table 1: Current and Future Modeled Traffic Volumes on US 93 and Baker Avenue

Location	Current/Future Modeled Traffic Volumes		2030 Volume As Compared to 2003 Volume
	2003 Volume	2030 Volume	
Spokane Avenue			
South of 13th Street	13700	28200	2.05 times higher
North of 13th Street	10900	17600	1.61 times higher
South of 6th Street	10400	14100	1.36 times higher
Between 6th and 5th Streets	8700	10800	1.24 times higher
Between 4th and 3rd Streets	7300	8900	1.22 times higher
South of 2nd Street	6400	8100	1.26 times higher
North of 2nd Street	3400	5100	1.50 times higher
2nd Street			
East of Spokane Ave	6200	9100	1.47 times higher
West of Spokane Ave	7600	11100	1.46 times higher
West of Central Ave	7900	12200	1.54 times higher
West of Baker Ave	9600	10500	1.09 times higher
Baker Avenue			
North of 2nd Street	12500	16700	1.34 times higher
South of 2nd Street	9100	12300	1.35 times higher
Between 5th Street and WF River	8000	10700	1.34 times higher
Between 7th and 8th Streets	10600	13900	1.31 times higher
North of 10th Street	10100	14000	1.39 times higher
Between 10th and 13th Streets	10400	15800	1.52 times higher
South of 13th Street	8500	12500	1.47 times higher
Central Avenue			
North of 2nd Street	2600	4900	1.88 times higher
South of 2nd Street	2100	4100	1.95 times higher
13th Street			
West of Spokane Ave	2100	4800	2.28 times higher
East of Spokane Ave	2000	9600	4.80 times higher

An analysis of these volumes can show how existing traffic patterns may change and help indicate where traffic problems may occur in the future. Simply put, as traffic volumes increase, vehicle flows generally deteriorate and delays increase. When traffic volumes approach and exceed the available capacity, the road begins to fail. For this reason, it is important to look at the size and configuration of the current roadways as an indication of their ability to accommodate future traffic demands.

Roadway capacity is of critical importance when considering the ability of existing facilities to accommodate future traffic volumes. The capacity of a road is a function of a number of factors including: how intersections along the corridor operate; the land use adjacent to the road and associated controls; side approaches and intersection spacing; road alignment and grade; speed; turning movements; and vehicle fleet mix.

The number of lanes is the primary factor used to evaluate roadway capacity, since any lane configuration has an upper volume limit regardless of its design. In general, two-lane roads can accommodate up to 12,000 vehicles per day. The model results for the year 2030 show the following roadway sections with volumes at or near 12,000 vehicles per day:

- Spokane Avenue (between 13th and 6th Streets):
- 2nd Street between Central and Baker Avenues:
- the north and south approaches at the intersection of 2nd Street and Baker Avenue; and
- Baker Avenue between the Whitefish River and 13th Street.

This indicates the current two-lane roadways may be at or exceeding their capacity by the year 2030 and suggests the need for design and/or operational changes to increase their capacity.

Segments within individual roadway corridors that have volume to capacity (v/c) ratios of 0.8 or higher are of concern because this limitation on road capacity leads to congestion.. Ratios of 1.0 or more suggest the road is beyond its ability to accommodate traffic flows. The **Technical Memorandum for Task 17: Analysis of the Existing Transportation System** noted that most of Spokane Avenue between Riverside Avenue and 2nd Street currently has v/c ratios ranging from about 0.80 to more than 1.0. Similarly, portions of Baker Avenue north of 2nd Street and between 6th and 13th Streets currently have v/c ratios higher than 0.84.

Since numerous roadway segments on the US 93 corridor and Baker Avenue already operate at or near their capacities, it is readily apparent that the ability of these existing roadways to accommodate traffic flows would continue to decrease as traffic volumes increase in the future.

Future Changes in Level of Service at Intersections along the US 93 Corridor

Urban road systems are ultimately controlled by the operation of their major intersections. Intersection failures reduce the number of vehicles that can be accommodated during peak travel hours at specific locations and lessen a roadway corridor's overall traffic volume capacity each day.

Level of Service (LOS) is a measure developed by the transportation profession to quantify driver perception for such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles. It provides a "report card" type rating scale corresponding to the operation of the intersection and how it accommodates the amount of traffic using it. LOS A, B, and C represent conditions where traffic moves without significant delays during peak hour travel demands. LOS D and E suggest progressively worse peak hour operating conditions. LOS F represents conditions where significant vehicle delays and congestion occur.

Each intersection along the US 93 corridor in Whitefish was analyzed using the procedures outlined in the Transportation Research Board's *Highway Capacity Manual – Special Report 209*, *Synchro* plus *SimTraffic 6* analysis software, and intersection traffic data obtained from the traffic model created for this study. **Table 2** shows the existing (2003) and future (2030) peak hour LOS and delay associated with each intersection along the corridor. The travel demand model assumes that intersections will not artificially limit corridor capacity.

Figure 2 shows existing and future LOS conditions at key intersections in Whitefish. The peak hour conditions were defined by taking twelve percent (12%) of the daily traffic volumes output by the traffic model. The peak hour volumes were input into *Synchro* to determine the traffic conditions at each intersection. Existing signal timing was used to analyze existing (2003) conditions. Optimal signal timing was applied to each signalized intersection in the future (2030) analysis to obtain the traffic conditions at that location.

Table 2: Intersection Delay and LOS at Intersections on US 93 and Baker Avenue based on Modeled Traffic Volumes

Intersection	Existing (2003) Condition		Future (2030) Conditions[1]	
	Delay (in Seconds)	Peak Hour LOS	Delay (in Seconds)	Peak Hour LOS
Spokane Avenue				
2nd Street (Signalized)	25.9	C	19.7	B
3rd Street	4.4	C	18.9	F
4th Street	4.7	D	101.8	F
5th Street	3.4	D	78.5	F
6th Street	4.9	F	34.3	F
8th Street	0.4	C	0.6	E
9th Street	1.2	E	0.0	A
Riverside Avenue	0.6	C	912.0	F
13th Street (Signalized)	10.9	B	75.6	E
2nd Street				
Central Avenue (Signalized)	16.3	B	16.4	B
Baker Avenue				
2nd Street (Signalized)	45.6	D	121.9	F
3rd Street	5.7	E	101.1	F
4th Street	3.2	D	143.5	F
5th Street	6.0	D	110.4	F
6th Street	3.7	C	37.5	F
7th Street	9.2	E	2781.2	F
8th Street	0.6	B	13.1	F
10th Street	1.1	D	846.8	F
13th Street	36.4	E	213.8	F

[1]*Optimized signal timing was used for signalized intersections.*

As **Table 2** illustrates, the peak hour LOS at most intersections on Spokane Avenue is anticipated to progressively worsen as traffic volumes increase. By the year 2030, almost all intersections along Spokane Avenue may operate at LOS E or F during the peak hour without improvements. Analyses also show that the operation of all intersections along Baker Avenue would deteriorate and may operate at LOS F by the year 2030 without improvements.

The poor overall peak hour LOS reported for unsignalized intersections along Spokane Avenue and Baker Avenue is the result of at least one of the movements at each intersection operating with significant delays and does not necessarily mean that the operations of the entire intersection are poor. The primary reason for the poor LOS ratings at unsignalized intersections along Spokane and Baker Avenues is the inefficient operation of side street approaches. Analyses suggest most major street approaches on Spokane and Baker Avenues would likely operate at an acceptable LOS (LOS

Figure 2

Figure 3-2

B or higher) in the peak hour through the year 2030. This is consistent with a fundamental priority to facilitate traffic flows on the arterial corridor.

At unsignalized intersections along Spokane and Baker Avenues with stop controlled side streets, the movements that most often experience significant delays include: minor street throughs, minor street left turns onto the major street, and major street left turns onto the minor street. High traffic volumes during peak hours on Spokane and Baker Avenues would severely inhibit side street traffic movements and result in significant delays for motorists attempting to enter traffic flows on these streets. The LOS analyses often predicted delays per vehicle of between 1 and 2 minutes and in some cases showed extraordinarily vehicle high delays indicative of system gridlock. Typical strategies to address long minor street delays involve prohibiting some of the minor street movements or installing a traffic signal at the intersection if warranted.

Please note that the "improved" LOS at the intersection of Spokane Avenue and 9th Street by the year 2030 is a peculiarity of the travel demand model and likely the result of little or no turning movements being assigned to the existing side street approach. There is no reason to believe this side street approach would operate any differently than other nearby intersections during peak hour conditions.

Highway capacity analyses for the signalized intersections at Spokane Avenue and 2nd Street and at 2nd Street and Central Avenue predict little change in LOS ratings at these locations during peak hours in 2030. This may be due in part because the intersection analyses assumed optimized signal timing at these locations. The poor operation of the intersection at 2nd Street and Baker Avenue may also inhibit traffic flows on 2nd Street and indirectly benefit the LOS at the intersections with Central and Spokane Avenues.

ANTICIPATED FUTURE TRANSPORTATION DEFICIENCIES

This section identifies future transportation deficiencies on the US 93 corridor based on the anticipated future traffic demands in Whitefish. In general, increasing traffic volumes, inadequate intersection or road geometries, and poor traffic flows will contribute to deteriorating traffic operations within the corridor. The most apparent future deficiencies on the US 93 corridor will be:

- the poor operation of unsignalized intersections on Spokane Avenue caused by excessive side street vehicle delays;
- deteriorating LOS at the signalized intersections of Spokane Avenue and 13th Street and 2nd Street and Baker Avenue; and
- the continued inability for the intersection of 2nd Street and Baker Avenue to completely accommodate trucks.

Failure resulting from inadequate capacity may result in traffic congestion and poor network performance. Traffic volumes that exceed or approach capacity levels cause increased delay along the roadway as well as on approach legs on side streets. As **Table 2** shows, significant increases in delay and resulting decreases in LOS are anticipated along Spokane and Baker Avenues during peak hours by the year 2030. This is most prevalent at the unsignalized intersections along the US 93 corridor. The high anticipated volumes of two-way traffic along Spokane and Baker Avenues will severely inhibit side street movements during peak hours in the future. As a result, almost all of the unsignalized intersections along Spokane and Baker Avenues are predicted to operate with a peak hour LOS of "F" due to the inability for traffic from the side streets to make left-turns or through movements onto the corridor.

By optimizing the signal timing along the corridor, all signalized intersections are expected to perform at a LOS of "C" or higher in the year 2030, with the exception being the intersection of 2nd Street and Baker Avenue which would operate at LOS F. The poor performance of the intersection is due to the expected high traffic volumes at this intersection. A lack of designated turn lanes and the absence of protected movements for turning movements during each signal cycle are the primary causes of operational problems at this intersection.

Truck traffic along the US 93 corridor inhibits traffic flows and affects operations at intersections in the downtown area. The sheer size of the trucks coupled with the short queuing distances between intersections creates congestion problems along the corridor. The intersections in the downtown area are difficult for trucks to negotiate. The small corner radii and tight intersection geometry makes maneuvering large trucks very difficult and dangerous. Trucks are often times encroaching on other lanes while making turns. Fewer vehicles are able to queue at intersections with truck traffic. The high number of trucks along the corridor increases delay and decreases safety in the area.